USER'S MANUAL for TPAC1008 series Operator panel

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1. Introduction

To grant a fast setup of the device please follow carefully the information in this manual.

1.1. Staff skill

Products described in this manual are devoted to PLC programmers or automation experts only. MECT S.r.l. declines any responsibility about malfunctioning or damage caused by incorrect use of MECT devices, due to noncompliance to this manual information. MECT S.r.l has an help desk.

1.2. Simbols

Danger
Follow this advice to avoid people injury.

Warning
Follow this advice to protect the device.

Caution
Follow this advice to have a more effective performance.

ESD (Electrostatic discharge)
Danger: possibly damage due to Electrostatic discharge.

Note
Step to follow for a correct installation.

Additional information

1.3. Terms

PLC:	TPAC1008
Terminals:	MPNC020; MPNC030
System:	PLC (TPAC1008) with terminals

1.4. Security

Attention
Switch off devices before connecting them.

ESD (Electrostatic discharge)
Modules have electronic components that can be damaged by. electrostatic discharge. Be sure to be connected to ground when handle the devices.

The instrument has no power switch and no internal fuse, but it powers on immediately after connecting a correct power supply input (check the power supply value on the instrument label). Keep the power supply line as short as possible and keep it separate from other power lines.
For security reasons it is necessary to have a 2 section power switch with a fuse near the instrument and easily replaceable.
Avoid the presence of other power actuators in the same control panel, high humidity, excessive heat and corrosive gas.
Instruments must have a power supply from security transformers or SELV transformers.

1.5. Reference manuals

ME7028 Mect configurator
ME7041 Quick Start

2. System description

TPAC1008 is a device composed by a PLC and a HMI with touch-screen monitor 7” width and 800 x 480 pixel resolution with 262.000 colors. TPAC1008 has digital and analogue input and output, field bus CanOpen and Modbus, and a 100Mbit/s Ethernet. The device can be applied in horizontal or in vertical design with the option "V" (see following pictures).

Figure 1: Front view TPAC1008 (horizontal version)

Figure 2: Front view TPAC1008 (vertical version)

2.1. Specification

TPAC1008 is based on a multiprocessor system. PLC and HMI are based on a 454MHz ARM9, I/O interface and I/O acquisition is based on a Cortex M3 processor. The 2 systems on different boards communicate over a CAN channel.

Table 1

PLC Hardware characteristics	
PLC Processor	ARM926JE 454MHz
RAM	128MB
FLASH	128MB
Non volatile variables	On FLASH memory
Real Time Clock	Yes with rechargeable battery
Screen 7”	TFT 800 x 480 pixel 262k colors
Touch screen	Resistive 4 wires
Ethernet	10Mbit/s - 100Mbit/s self recognition
USB	Host 2.0
I/O hardware characteristics	
Processor	Cortex-M3 72MHz
PLC software characteristics	
OS	LINUX 2.35
PLC	IEC61131-3
Graphics	Based on QT library
CAN	CanOpen 2.0
ModBus	Modbus RTU master
Storage memory	Possibility of history storage

3. Hardware Installation

In the following figures see the TPAC1008 dimensions.

3.1. Mechanical dimensions

Side view

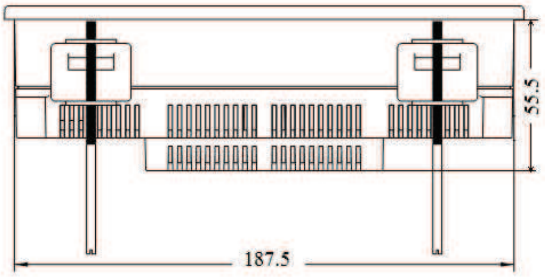

Figure 3

Rear view

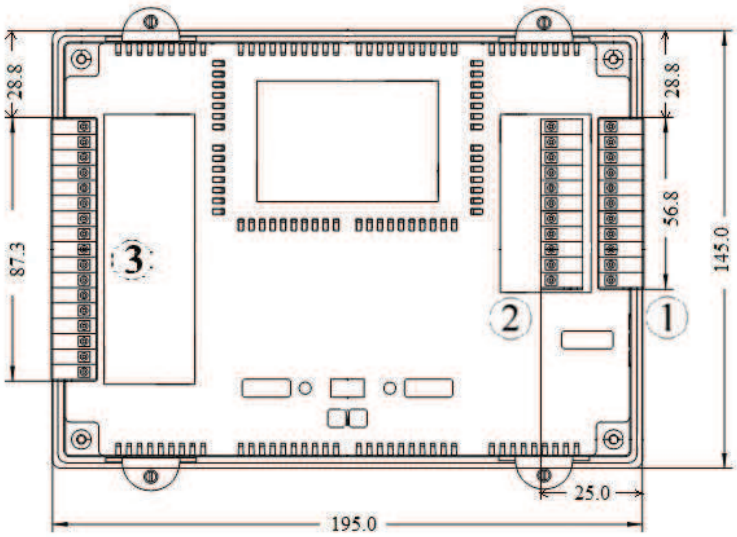

Figure 4

Side view

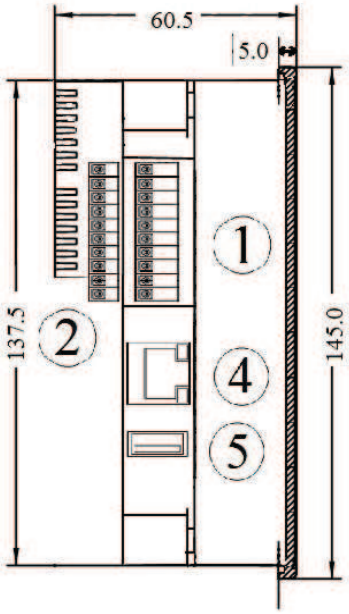

Figure 5

Technical specification

Table 2

Mechanical				
Material	Polycarbonate, Polyamide 6.6			
Dimensions W x L x H	195 mm x 145 mm x 60.5 mm			
Mounting plate	139mm x 189mm			
Installation	Panel installation			
Environmental conditions				
Operative temperature	0 °C ... 55 °C			
Storage Temperature	-20 °C ... +85 °C			
Relative Humidity	5 % a 95 % no condensation			
Electric isolation				
Air clearance	According to IEC 60664-1			
Pollution According to IEC 61131-2	2			
Protection				
Rear protection	IP 20			
Front protection	IP65			
EMC				
EMC according to EN 61000-6-2 (2001)				
Test specification	**Values**		**Class**	**Criterion**
EN 61000-4-2 ESD	4 kV/8 kV (contact/air)		2/3	B
EN 61000-4-3 electromagnetic fields	10 V/m 80 MHz ... 1 GHz		3	A
EN 61000-4-4 burst	1 kV/2 kV (data/supply)		2/3	B
EN 61000-4-5 surge	Data:	-/- (line/line)		B
		1 kV (line/earth)	2	
	DC supply:	0.5 kV (line/line)	1	B
		0.5 kV (line/earth)	1	
	AC supply:	1 kV (line/line)	2	B
		2 kV (line/earth)	3	
EN 61000-4-6 RF disturbances	10 V/m 80 % AM (0.15 ... 80 MHz)		3	A
Emissions according to EN 61000-6-4 (2001)				
Test specification	**Limit values/IQPI**	**Frequency Range**		**Distance**

EN 55011 (AC supply, conducted)	73 dB (µV)	500 kHz ... 30 MHz	
EN 55011 (radiated)	40 dB (µV/m)	30 MHz ... 230	10 m
	47 dB (µV/m)	230 MHz ... 1	10 m
Emissions according to EN 61000-6-3 (2001)			
Test specification	**Limit values/IQPI**	**Frequency Range**	**Distance**
EN 55022 (AC supply, conducted)	66 ... 56 dB	150 kHz ... 500	
	56 dB (µV)	500 kHz ... 5	
	60 dB (µV)	5 MHz ... 30	
EN 55022 (DC supply/data, conducted)	40 ... 30 dB	150 kHz ... 500	
	30 dB (µA)	500 kHz ... 30	
EN 55022 (radiated)	30 dB (µV/m)	30 MHz ... 230	10 m
	37 dB (µV/m)	230 MHz ... 1	10 m

Digital input	8	Input Range 0 - 24Vdc +/- 15%
Digital output	12	Max current for each digital output: 500mAdc@24Vdc
Analogue input	4	PT100, TCJ, TCK,TCT, 0-10Vdc,4(0)-20mA
Analogue output	2	0-10Vdc, 4(0)-20mA
Power		10 W no load

Attention
Install the device in a panel with no more than 55 °C.

3.2. Panel mount

3.2.1. Distance

System must be installed with a space for heat dissipation and cabling. Avoid cabling superimposing to avoid EMC problems.

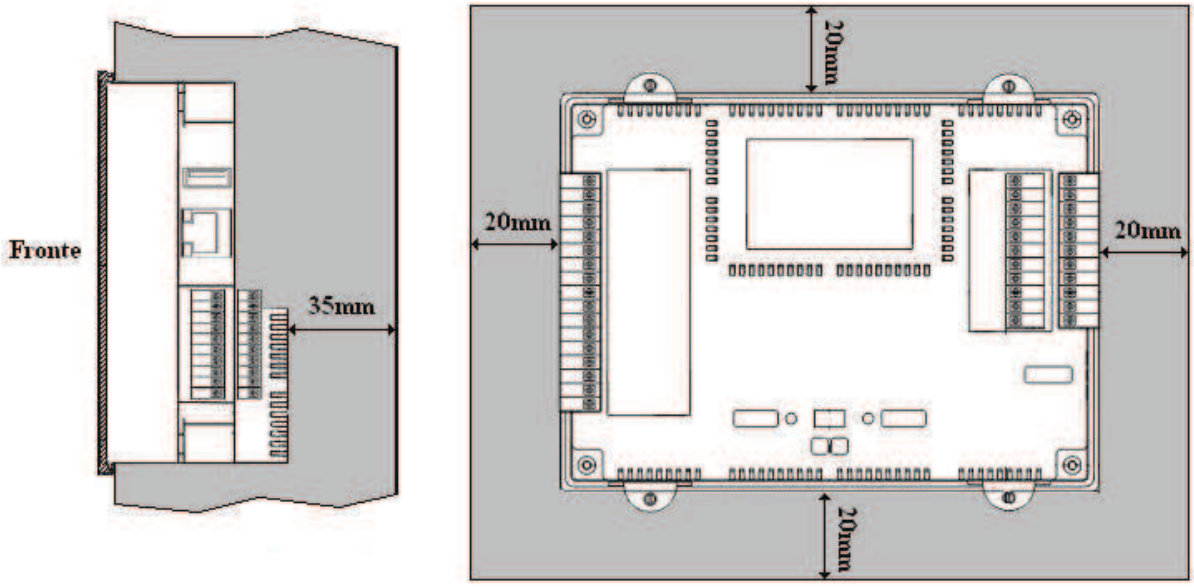

Figure 6A: Horizontal mounting

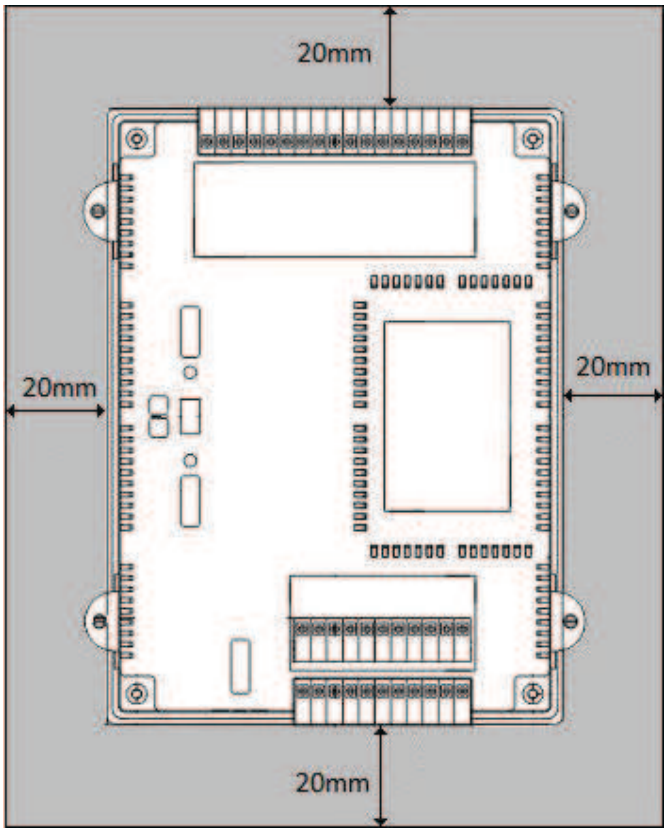

Figure 6B: Vertical mounting

4. TPAC1008 wiring

4.1. Connections

In the following figure see the wiring diagram with the available I/O.

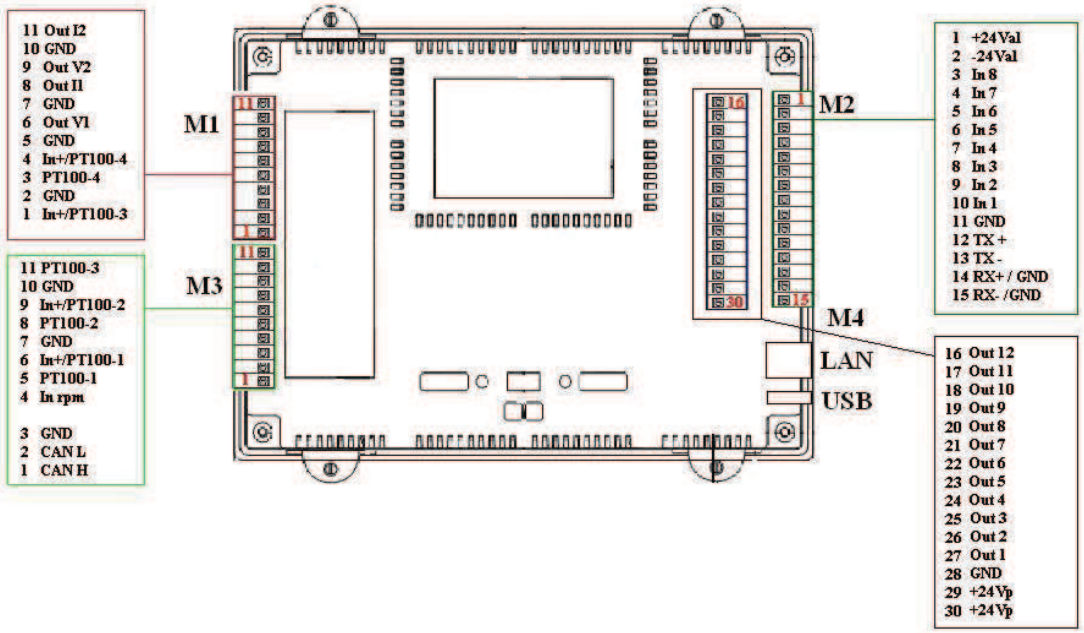

Figure 7: Pinout PLC

M4 connection terminal is the expansion board terminal, and can be different according to different available models.

Table 3

TPAC1008 01				
Analogue input	N° 4	**Input type**	**Resolution**	**Note**
		4÷20 mA	0.01mA	Input impedance 9Ω
		0÷10V	0.005V	Input impedance 1MΩ
		thermocouples J(0°C – 600°C), T(0°C – 400°C), K(0°C – 1200°C)	1°C	Cold junction compensation
		PT100 r -40.0°C – 200.0°C	0.1°C	
		PT100 E -40°C-800°C	1°C	
Analogue output	N° 2	**Output type**	**Resolution**	**Note**
		4÷20 mA	0.005mA	Max Impedance: 400Ω
		0-10V	0.003V	Min Impedance: 1KΩ
Input (rpm)	N° 1	**Input type**	**Resolution**	**Note**
		rpm	Max Frequency 1kHz (60000 rpm)	
Digital Input/Encoder input	N°8	**Input type**	**Resolution**	**Note**
		PNP	Max Frequency 500Hz	input 2 and 3 can be used as incremental encoder input Fmax 40kHz D2: A input D3: B input
Digital output	N°12	**Output type**	**Resolution**	**Note**
		PNP	Max Frequency 500Hz	Max 500mA for each output. 2 A max total load
Power supply		24Vdc ±15% 400mA		
I/O power supply		24Vdc ±15%		
CANOpen		1 channel		
		Max Bit rate: 1Mbit/sec		
		Cycle time: 10msec		
USB A		2.0		
Ethernet		Bit rate: 100Mbit/sec		
Serial output		RS485 full duplex (by hardware configuration)		

4.2. Power supply

4.2.1. Isolation

Device has no galvanic isolation between input, output and power supply.

4.2.2. System power supply

TPAC1008 has a 24VDC (-15% +20 %) according to the scheme in the figure. System is protected against reverse power supply.
As shown in the figure, the digital outputs must have a separate power supply respect the main power supply of the instrument.

4.2.3. Digital output power supply

TPAC1008 digital outputs must have a separate power supply respect the main power supply of the instrument to avoid consequences on control system due to I/O problems.

4.2.4. Fuse

System has no internal fuse , so is suggested the use of an external 1A fuse for the panel power supply, and an external 3A delayed fuse for the I/O power supply.

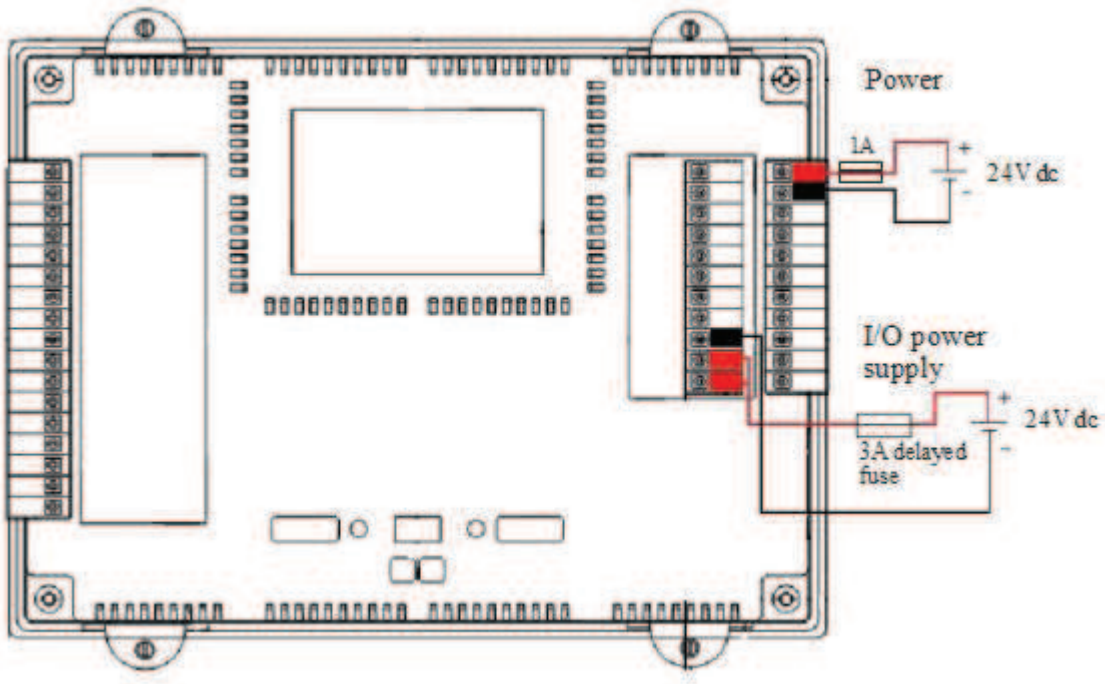

Figure 8

Attention
A wrong value for the power supply can cause a damage to the device.

4.3. Digital input/output wiring

The digital I/Os are PNP type, the wiring must follow the scheme below.

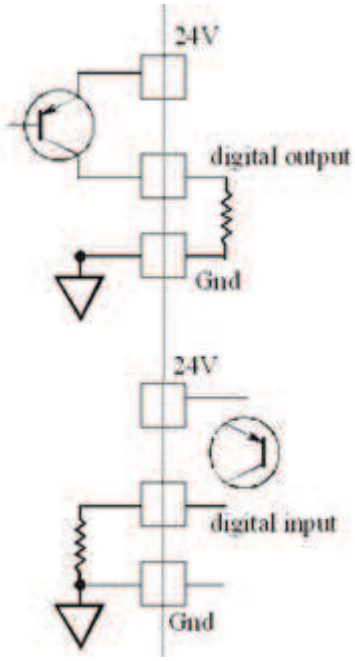

Figure 9

Each digital output can source a 500mA max, and the total current can be lower than 2A.

4.4. Analogue input wiring

By means of the PLC program the TPAC1008 can be configured to connect several analogue input type. Configuration is done by the setup of a system variable in the PLC program. Configuration can be set up and modified in any moment.

Configuring input as thermocouple it is possible to connect up to 4 of the following type:

- J (0°C – 600°C),
- K(0°C – 1200°C)
- T (0°C – 400°C)

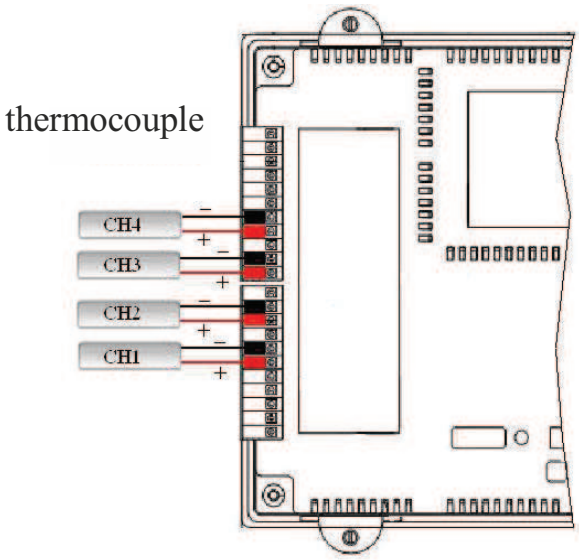

Figure 10

TPAC1008 can be connected to PT100. 2 different scales are possible:

- –40.0 °C to 200.0°C
- –40 °C to 800°C

The scale –40.0°C to 200.0°C has a resolution of 0.1°C.
The scale –40°C to 800°C has a resolution of 1°C.

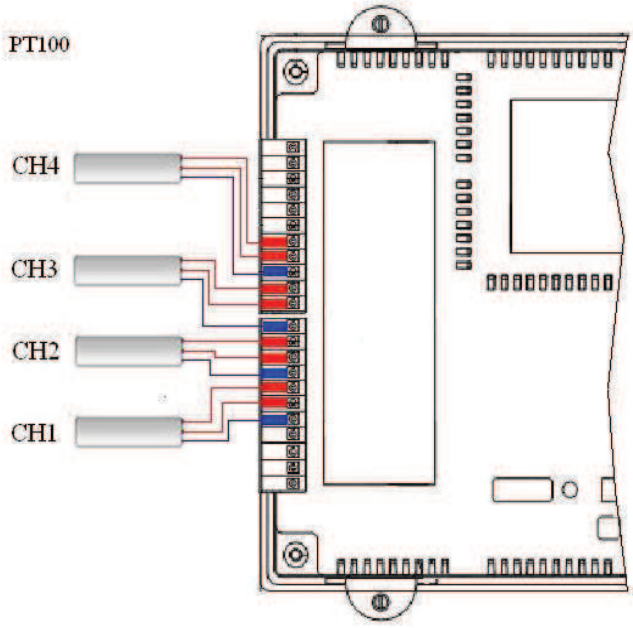

Figure 11

Configuring input as 0÷10V or 4÷20mA is possible to connect up to 4:

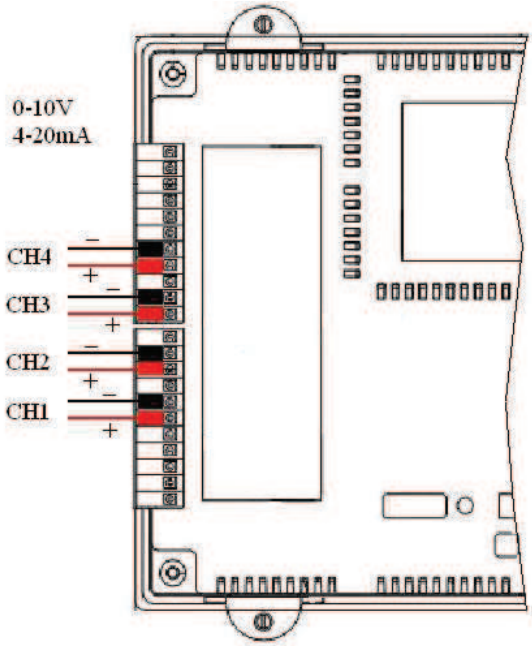

Figure 12

4.5. Analogue output wiring

2 analogue output channels are available.
See in the figure the current analogue output wiring.

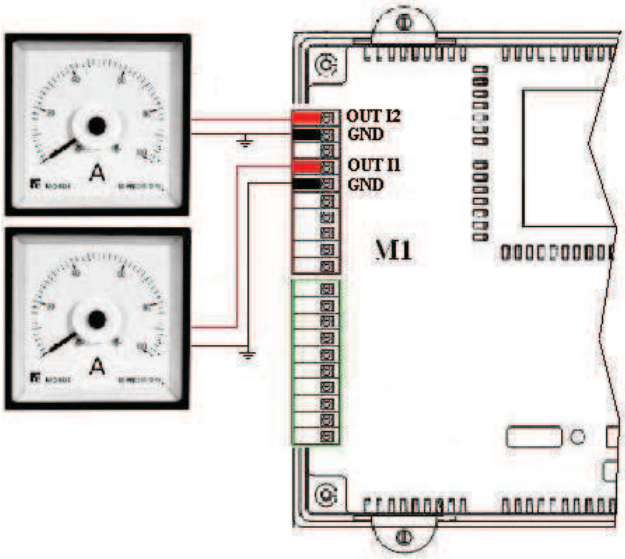

Figure 13

See in the figure the voltage analogue output wiring.

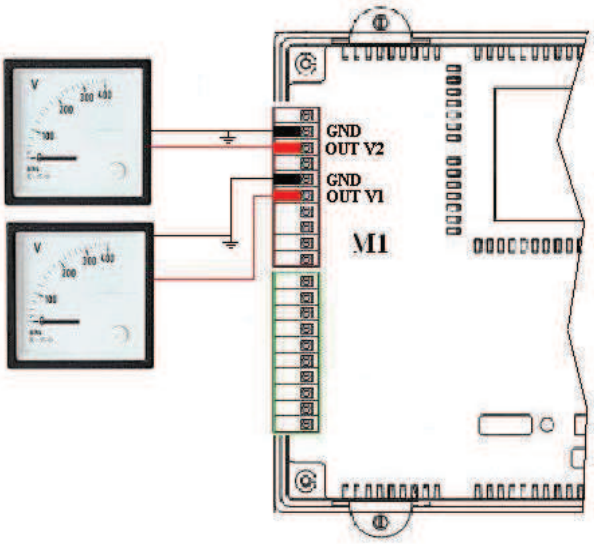

Figure 14

4.6. CanOpen wiring

Can interface on TPAC1008 is on M1 terminal board on pins:

Table 4

Pin	Segnale
1	CAN H
2	CAN L
3	GND

Example of a wiring of a system composed by:

- MPNC010
- MPNC020
- MPNC030
- TPAC1008

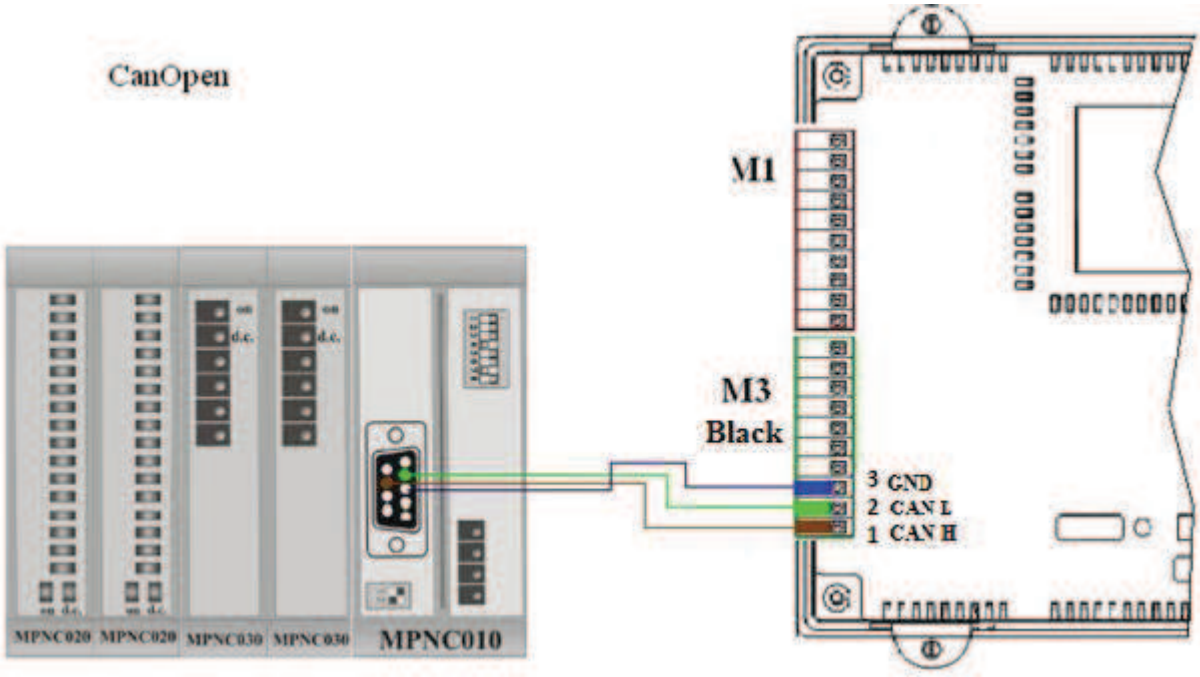

Figure 15

Cable type

Cable between TPAC1008 and CANopen slave must be a shielded twisted pair, and to avoid external disturbances the shield must be connected to both 0V of the communicating systems. The cable length is a function of the baud rate as follows.

Table 5

Baud rate	Bus Lenght
1 Mbit/s	10 m
800 kbit/s	50 m
500 kbit/s	100 m
250 kbit/s	250 m
125 kbit/s	500 m
50 kbit/s	1000 m

Terminal resistance

Inside the TPAC1008 there is a resistance of 120Ω to terminate properly the bus on the master side.

To configure the CAN communication see the TPAC tutorial.

4.7. ModBus wiring

ModBus on TPAC1008 is a 4 wire RS485 serial line, on the M2 terminal board on pins:

Table 6

Pin	Segnale	Description
11	GND	
12	TX +	Line + Tx
13	TX -	Line - Tx
14	RX +	Line + Rx
15	RX -	Line - Rx

Example of a wiring of a system composed by:

- TPLC005
- MPNC020
- MPNC030
- TPAC1008

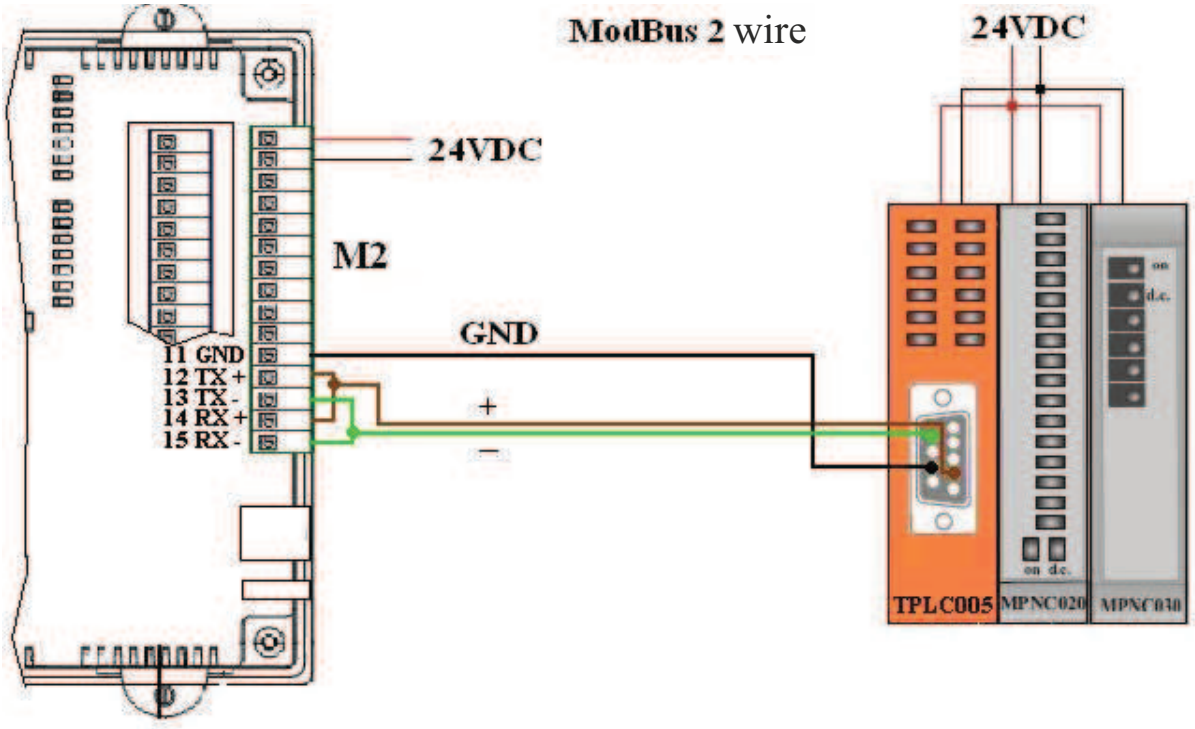

Figure 16

5. Peripherals

5.1. USB

TPAC1008 has an USB 2.0 host for:

- software update.
- data storage: datalogger.
- Connect USB peripherals as printers, mouse, etc.

Specific connection of external peripherals are implemented on request.

5.2. Ethernet

TPAC1008 has a 10/100Mbit/s ethernet port with autoconfiguration, with direct or inverse connection cable.

TAPC1008, by ethernet, can be controlled by a personal computer, it is possible to control the I/O of TPAC1008 by means of a program on a PC.

6. PLC and HMI

To program TPAC1008 it is necessary to develop 2 software.
A PLC program written with the PLC program IDE software.
A human machine interface program (HMI) written with Qt Creator.

A PLC program can be written using one of the following standard IEC 61131-3 languages:

Table 7

FBD	Functional Block Diagram	Graphic	Contact scheme
LD	Ladder	Graphic	Ladder scheme
SFC	Sequential Function Chart	Graphic	State diagram
ST	Structured Text	Text	Pascal-like language
IL (AWL)	Instruction List	Text	Assembler-like language

The 2 programming environment (PLC and HMI) are for windows OS.

6.1. System variables

Here some system variables available for PLC program.

Table 8

Variable name	Number	Type	Description
PLC_StatusReg	-	UINT	Firmware revision
PLC_AnInConf_1 **PLC_AnInConf_2** **PLC_AnInConf_3** **PLC_AnInConf_4**	4	UINT	Analogue input configuration: • 0 not configured • 1 current • 2 voltage • 3 TCJ • 4 TCK • 5 TCT • 6 PT100E • 7 PT100R Ex°: ch1 = TCT **PLC_AnInConf_1 := 5;**
PLC_AnOutConf_1 **PLC_AnOutConf_2**	2	UINT	Analogue output configuration: • 0 not configured • 1 current • 2 voltage Ex°: ch1= not configured **PLC_AnOutConf_1 := 0;**
PLC_DigIn_1 **PLC_DigIn_2** **PLC_DigIn_3** **PLC_DigIn_4** **PLC_DigIn_5** **PLC_DigIn_6** **PLC_DigIn_7** **PLC_DigIn_8**	8	INT	Digital input value
PLC_AnIn_1 **PLC_AnIn_2** **PLC_AnIn_3** **PLC_AnIn_4**	4	INT	Analogue input value
PLC_Tamb	-	INT	Temperature of cold junction
PLC_EncoderLo	-	UINT	Reading encoder (lower part)
PLC_EncoderHi	-	UINT	Reading encoder (upper part)
PLC_DigOut_1 **PLC_DigOut_2**	12	INT	Digital output value

PLC_DigOut_3 **PLC_DigOut_4** **PLC_DigOut_5** **PLC_DigOut_6** **PLC_DigOut_7** **PLC_DigOut_8** **PLC_DigOut_9** **PLC_DigOut_10** **PLC_DigOut_11** **PLC_DigOut_12**			
PLC_AnOut_1 **PLC_AnOut_2**	2	INT	Analogue output value
PLC_EncEnable	-	UINT	Enable encoder: • 0: disable encoder • 1: enable bidirectional encoder Ex°: Encoder = disable **PLC_EncEnable := 0;**
PLC_EncoderReset	-	UINT	Encoder reset

To use expansion board IO in a PLC insert statement **`#import`** **"LIO_TPAC1006.gvl"** in the program or function block where you need expansion variables.

After that the variables are available in read / write mode as described in the program tutorial.
The system can use 5472 interchange variables between HMI and automation (at maximum) which include:
internal variables, interchange variables on Modbus network, retentive variables.
The variables are defined by a software "Mect Suite".

7. How to order